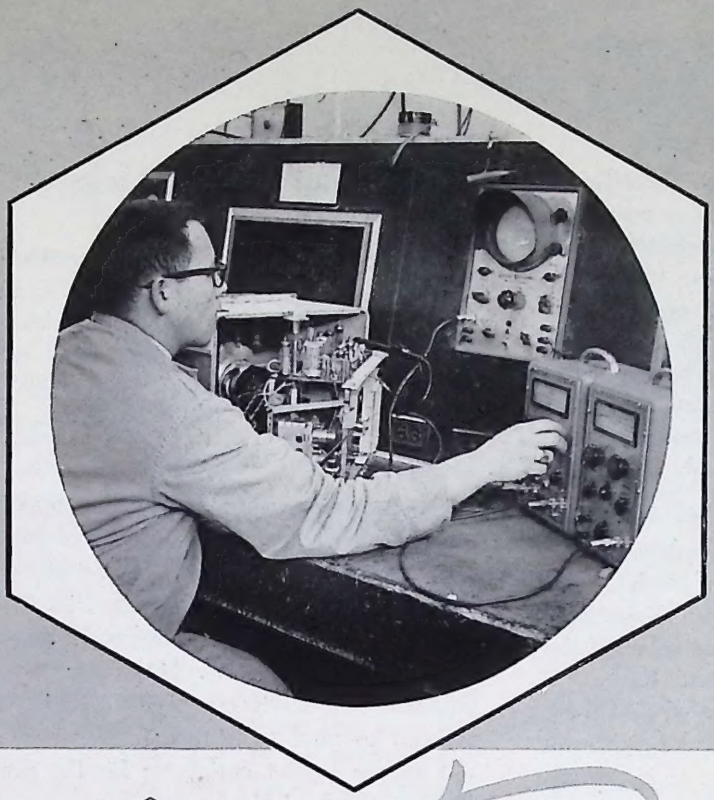
MARCH-
APRIL
1959
EDITOR: AL JONES



ROGERS Booster

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A MAGAZINE DEVOTED TO THE INTERESTS OF RADIO—TV TECHNICIANS IN CANADA

Better TV For Southern Manitoba — Winnipeg and Red River Valley communities may be getting TV reception from Pembina, North Dakota, next year when the operators of KNOX-TV open a new station there. Localities such as Altona, Morris, Emerson and Winkler should get excellent reception of top American network programs. At the present moment, Emerson and Pembina get only fair reception from the CBC station in Winnipeg.

Those Hard-Working Technicians — We regret there are no figures available for Canada but this report from New York State will give a general idea of what the technicians are doing. In that state a TV service association has estimated that there are 15,000 technicians who make eight million service calls per year.

Drawing the Color Line — In connection with the above, a survey recently conducted to determine the type of people who buy color TV is most interesting. Sixty-five percent have incomes over $7,500 and forty percent have $10,000 or more. The color set owner is better educated than the average citizen, half being in executive positions, are professionals or own their own businesses. They are important sources of personal influence and are more active in their communities as compared with black-and-white set owners.

Radio-TV Patents Freed — Through a judgement handed down in Federal Court, some 12,000 radio and TV patents held by the Radio Corporation of America will be opened to the entire industry. Whereas patents were previously licensed to others on a package basis only, applicants will now be able to choose the patents they actually require. In addition, 100 color TV patents held by the Corporation will be pooled with others interested in color TV development.

Color Sets Still Growing in the U.S. — In 1954 there were only 10,000 color TV sets in use. By the end of this year there will be somewhere between 375,000 and 400,000 in use. Sales in the first half of 1958 were 45,000 units as compared with 40,000 in the first half of 1957.

Foreign Competition — Japan's exports of transistor radios to the world have been running at the annual rate of one million units, more than 60% going to the U.S. The capacity of 40 firms is reputed to be about two million per year . . . At the same time, Japanese manufacturers of TV sets have decided to pool their technical resources and set up a joint enterprise for the production of color TV picture tubes.

Japanese Transistor Import Control — The Electronic Imports Committee of the EIA, at a recent meeting held in San Francisco, was authorized to request the Office of Civil and Defence Mobilization to investigate the threat to national defence from increasing imports of Japanese-made transistors. It was claimed that, unless some controls or quotas are adopted, the U.S. electronics industry will be forced to curtail its investments in research and development of transistors.

Front Cover

I.F. Alignment of a portable TV receiver being checked using an oscilloscope in conjunction with sweep and marker generators. Panel-mounting the scope takes up less bench room allowing the other test equipment and the chassis to be concentrated within easy reach.

Checking I.F. Alignment

Most TV manufacturers give detailed alignment instructions in their service manuals. A few mention only the circuits they feel are likely to require re-alignment. At least one does not mention alignment at all. (We are speaking here of reputable manufacturers who presumably have the facilities for providing such information. Unfortunately, in Canada, there have been several who disappeared without releasing *any* information on their sets.)

There can be two points of view on the matter of supplying alignment information. One maker may feel that his design differs sufficiently from the standard that specific details should be given. Another may feel that alignment should not normally be necessary and, if it should be, standard procedure should be satisfacory.

It is true, of course, that complete alignment is not usually necessary but, especially in older sets, there are many things that can be disclosed by a sweep check. It will, for example, disclose the stage with poor gain or the point in the strip where i-f regeneration is occuring.

Which Instruments? — A VTVM is frequently specified for peaking i-f stages but, if the scope is going to be used later for viewing the waveform, it would be just as well to use it in the first instance. The VTVM will indicate a peak all right but it will not show whether this peak is as high as it should be. Thus, inspection with the scope later may indicate a readjustment is necessary. If the scope is set up as a voltmeter, voltage can be checked while the waveform is being observed. This speeds things up because, should the gain be low at one point, alignment can be discontinued momentarily while that fault is being investigated.

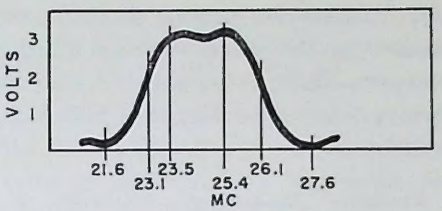
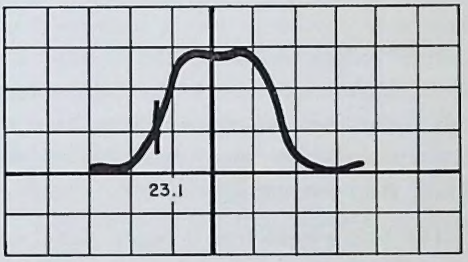
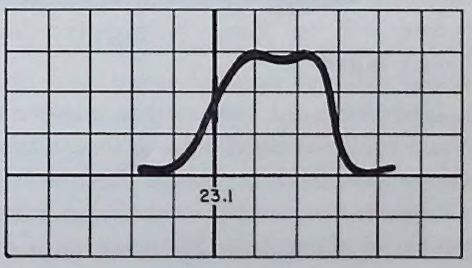


Figure 1 shows a typical i-f response curve with the output voltages at various frequencies and so, if we wish to identify one of these points (say 23.1 mc) we must superimpose a pip from a marker generator. This is shown in Figure 2.



The background lines in Figure 2 are those on the transparent overlay that is always placed over the scope screen for voltage measurement etc. Now the scope horizontal centering control may be used to shift the pattern across the screen until the pip rests on the heavy centre line as shown in Figure 3. Then the marker generator can be turned down so the pip does



not disturb the waveform and thereafter the centre line can be taken as representing 23.1 mc. The next step is to adjust the 23.1 mc coil or transformer so that the curve crosses the centre line at its highest point. It is then peaked to 23.1 mc.

The marker can now be set to the other frequencies shown and corresponding adjustments made, using the manufacturer's chart (rather than Figure 1) if such is available.

Auxiliary Equipment — Naturally it is most important that correct bias be applied to the a.g.c. line when the i.f. is being aligned. If the manufacturer's specifications are not available, it is usual to apply about 3 volts negative.

The simplest bias box consists of a potentiometer across a 4.5 volt battery. You may choose to use a high-resistance pot to reduce drain on the battery and, if so, be sure to check the bias voltage when the box is connected to the set. Otherwise loading may make the voltage lower than you expect.

The best way to feed a sweep signal into an i-f strip is with a dummy oscillator-mixer tube with the oscillator section put out of commission by cutting off its grid pin. The coaxial cable from the sweep and marker generator connects between the mixer shield and chassis, the shield being raised to disconnect it from the chassis. The cable should be terminated with a resistance equal to its characteristic impedance to avoid standing waves. A number of variations of this simple signal injection system will be found in manufacturers' service bulletins.

Other Hints — A thin marker is easier to locate on the slope of a curve than a thick one and the thickness can be controlled by a capacitor across the vertical-input terminals of the scope. Its value must be found experimentally but, thereafter, will hold good for all future jobs.

It is best to use more gain in the scope and keep the output of the sweep generator low. If the latter is too great, a nice flat-topped curve may be obtained due to saturation in the i.f. tubes but the curve will be nothing like this under normal operating conditions.

Special Cases — When alignment is done originally at the factory it is necessary to assume that the set will be operated under average conditions and so some modifications may be made in practice. Where nothing but fringe reception is available, for example, alignment may be done with a bias of about 1 volt. Or, in an area where only strong signals are received, it could be set at 4 volts. The idea here is to make the response correct at the bias voltage that will actually be developed under operating conditions.

It is also possible to modify the shape of the curve in special cases with good results. For fringe reception only, the bandwidth can be reduced to 2.5 mc with a resultant increase in sensitivity. On the other hand, where all signals are strong, some gain can be sacrificed and the bandwidth increased. The result will be better picture detail.

Back Cover

A reduced version of one of the current Rogers tube ads is shown on the back. In these ads we are featuring tubes designed for those "extra special" applications. If you wish further information on these tubes or on other types that we have not yet had the opportunity to feature, drop us a line and one of our technical personnel will be glad to help you.

Waveforms and the Oscilloscope

In many electronic applications, such as television, radar and computers, the development of special waveforms is a basic essential. As we all know by now, the oscilloscope is the only readily available instrument for checking such waveforms. This being the case, it naturally follows that all good technicians will be familiar with the many applications of this device.

Many technicians use the scope in their every day work for alignment and checking voltages but we suggest that a further step be taken. When business is quiet for a moment or on an evening when you-know-who has gone out to play bingo, try experimenting with the scope; first on circuits you are entirely familiar with and then with some you are wondering about. Here *familiarity* is the keynote. It is somewhat like reading Braille and you will be amazed at the story that can be told by a scope pattern if you have already observed hundreds of them under known conditions.

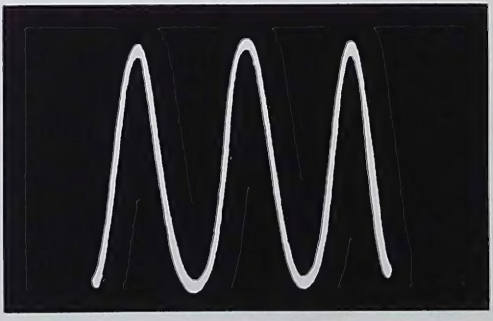
However, before going into the practical applications of the scope, we would like to make some preliminary remarks on waveforms in general.

The Sine Wave — When a loop of wire rotates at constant speed in a uniform magnetic field, the induced alternating voltage rises and falls in a sine wave pattern. It is so-called because the voltage at any instant is proportional to the sine of the angle through which the loop is passing.

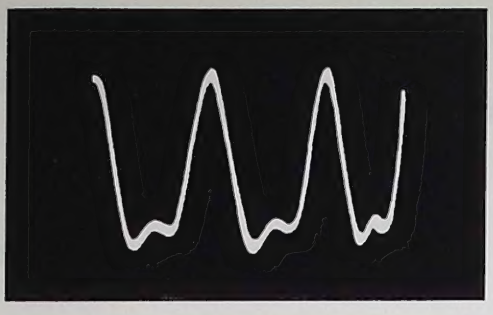
If you are not familiar with trigonometry, let's not stew about it. The sine is just a ratio. You can understand that, if a conductor cuts a magnetic field at a right angle, it will have more voltage induced in it than if it slides across it almost parallel to the field. (A somewhat corny example is the file which, when run sideways across a piece of material, cuts less metal than when run lengthwise.)

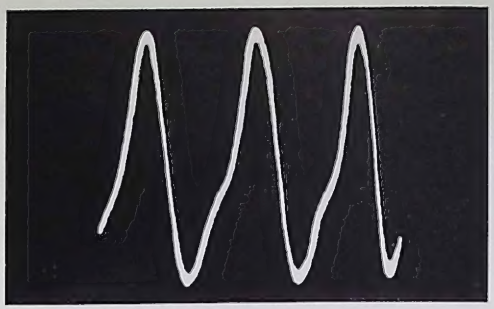
A pure sine wave consists of only one frequency and is not easy to produce either by an electrical generator or by an electronic oscillator. In the first instance it is difficult to provide a uniform magnetic field and, in the second, it is difficult to find a purely linear device.

Figure 1 is an example of this. It closely approaches a sine wave but actually contains 10% second harmonic distortion. This one could easily fool you unless you observe it closely. Note that the succeeding cycles are not uniform but that there is a slight spreading of the trace.



Harmonic Content — If you feed a pure sine wave voltage into an amplifier you do not necessarily get the same waveform at the output. A tube driven near saturation, for example, can cause a flattening of the waveform. Carried to an extreme, this could produce an almost square waveform.





(Which is exactly what we want in some cases.)

But you cannot designate complex waveforms in terms of "so much flatness" or "this one looks like Marilyn Maxwell". Fortunately, any deviation from a pure sine wave can be duplicated by the mixture of an initial sine wave (called the fundamental) and one or more sine waves of multiple frequency (called harmonics).

For example, if our fundamental frequency is 60 cycles, the second harmonic is 120 and the third 180 cycles.

In the amplifiers we use everyday, and in which we try to avoid distortion, harmonics up to the fifth are usually the important ones. On the other hand, if we are trying to produce this effect, it may take as many as 20 harmonics of suitable amplitude and phase to produce a reasonable square waveform.

Some Examples — Before going into the extreme waveforms that we have to produce for specific applications, it may be wise to look at a few milder cases that occur unintentionally.

Figure 1 has already shown a small (10%) second harmonic component. Figure 2 shows what happens when this is increased to 30%.

So far this looks like a simple development. But don't let it fool you. Here is where your experience with the scope will pay off. When you mix two frequencies, the phase as well as the amplitude is important. In Figure 3 the second harmonic has been increased to 40% (which would not change it too much from Figure 2) but the phasing of the harmonic has been changed. Figure 3 looks far the worse of the two but actually is only 10% more severe than Figure 2.

We will return in the next issue to mess up these waveforms still further.

TIPS FOR TECHNICIANS

Cleaning TV Tuners — I find a child-size toothbrush a handy tool for cleaning switch-type TV tuners. First I apply a little cleaning fluid and then gently work the brush back and forth over the contacts while rotating the switch.

C. F. HENDERSHOT, Stevensville, Ont.

$5 Send us your latest original service hint. If previously unpublished and found suitable for publication, you will receive a cheque for $5.00.

What's New in Tubes?

Products mentioned in the series "What's New in Tubes?" are available through Rogers distributors across Canada. Complete data sheets or further information may be obtained by writing direct to Rogers Electronic Tubes and Components, Technical Information Service, 116 Vanderhoof Avenue, Toronto 17, Ont.

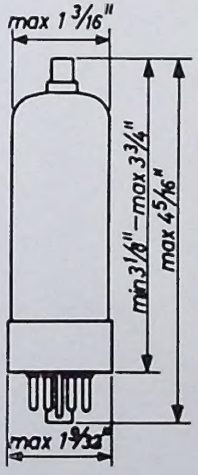
Rogers 6CM5: The horizontal output tube has undergone a series of developments paralleling the increasing deflection angles in picture tubes. The tube types most suitable for this function is the beam power amplifier or power pentode, originally used in radio receiver audio output. The 6BG6G was the first beam power amplifier designed for this job. Along with 70° picture tubes came the 6BQ6GT, which, after slight modification was capable of deflecting 90° tubes. For 110° deflection a new more powerful tube was required, resulting in the new widely used 6DQ6A and for TV receivers having low B supply voltages the 6DN6 was developed.

Features desirable in such a tube include capacity for wide angle deflection. This, in the tube, means high plate current at low plate and grid No. 2 voltages and at near zero bias conditions. The break or Knee in the curve, showing plate current vertically versus plate voltage at zero bias, must be at a low plate voltage. This aids deflection and reduces "snivets". Snivets are vertical black bars near the right edge of the picture tube and are believed to be caused by negative kinks around the knee of the plate current vs the plate voltage curve. High cathodal currents, high electrode dissipations and voltages are also required. Further there should be no Barkhausen oscillations which cause black bars near the left edge.

The Rogers 6CM5 was optimized for the TV horizontal output function. Pin-connection-wise it is identical to the 6DQ6A except that 6DQ6A pin 1 has a shield connected. The 6CM5 has no connection made to this pin.

The 6CM5 is now used by a major TV manufacturer for 110° deflection. It is expected that other manufacturers will follow. A 600 MA heater version of this tube will shortly be available.

TUBE OUTLINE

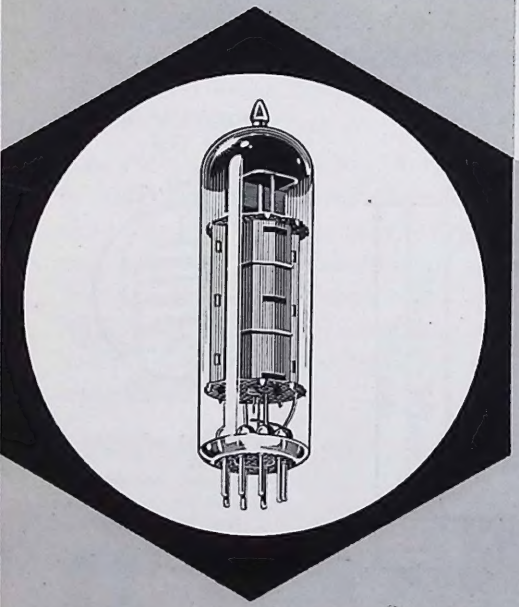


BOTTOM VIEW OF BASE

1. Internal connection
2. Heater
3. Internal connection
4. Grid No. 2
5. Grid No. 1
7. Heater
8. Cathode, grid No. 3 Top Plate

Typical Characteristics:

Plate voltage	100
Grid No. 2 voltage	100
Grid No. 1 voltage	—7.7
Plate current	100
Grid No. 2 current	7.0
Transconductance	14,000
Plate resistance	5,300



The Rogers 6BQ5 Pentode for High Quality Amplifiers and Receivers. It is a 12 watt dissipation pentode which provides high peak power of up to 17 watts output with very low distortion (4%).

The Rogers 6BQ5 (the world famous EL84) has been designed for two prime applications – as a sound output tube in high fidelity amplifiers and high quality television receivers; as a vertical output tube where special factory tests ensure good linearity and high zero-bias plate knee current.

ROGERS

electronic tubes & components

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